

ROAD NETWORK DEVELOPMENT AND MANAGEMENT: BANGLADESH PERSPECTIVE

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Perspective

1. Introduction

Due to significant shift from other mode of transport like water and rail to road transport during last three decades, road network in Bangladesh now plays a major role in the transportation system, which had shares for passenger and freight of 73% and 63% respectively in 1996 (TSC, 2006). The paved roads in Bangladesh increased from 3600 km in 1971 to 50,000 km in 2005 (RFEO, 2006). The road network in Bangladesh are broadly divided into Highways and Rural Roads and two main Road agencies, Roads and Highway Department (RHD) and Local Government Engineering Department (LGED) are responsible for managing them. It has been observed in last few decades that Government of Bangladesh (GoB) has focused on building the road infrastructure with the active support of Development Partners (Donors) and budgetary allocation was provided in Annual Development Programme (ADP) with special emphasis in connecting the missing links but very negligible attention is given to maintain the completed road projects resulting deterioration of the pavement structure and accumulation of back log for maintenance needs. Issues like road safety, environmental issues and above all potential data collection and preservation etc. were mostly unknown or ignored. The situation was highlighted in different studies initiated by the development partners and in last decade several steps were taken by the GoB and in April 2004 National Land Transport Policy (NLTP) was approved by the cabinet and Integrated Multimodal Transport Policy (IMTP) is under consideration for approval by the cabinet. With these events and other associated matters like creation of a Road Maintenance Fund, comprehensive Data Base and using HDM-4 tool by RHD to analyze data for prioritizing rehabilitation and maintenance programme etc are the turning point for the road managers and engineers and sustainable management of network is apparently formidable challenge in attracting GoB's allocation while other sectors like health, education, poverty alleviation are the potential priority sectors,

2. Road Network in Bangladesh

The road network of Bangladesh comprises National Highway (NH, major roads), Regional Highway (RH, secondary roads), Zilla Roads (ZR, tertiary roads), which are constructed, developed and maintained by the RHD. Upazilla Roads, Union Roads and Village Roads are predominantly the rural roads are constructed and managed by the LGED. City Corporations deal with urban roads in metropolitan cities. Sometimes Local Councils do manage a minor part of the network in their jurisdiction. Details of the road classes and responsibilities in Bangladesh can be seen in Table-1.

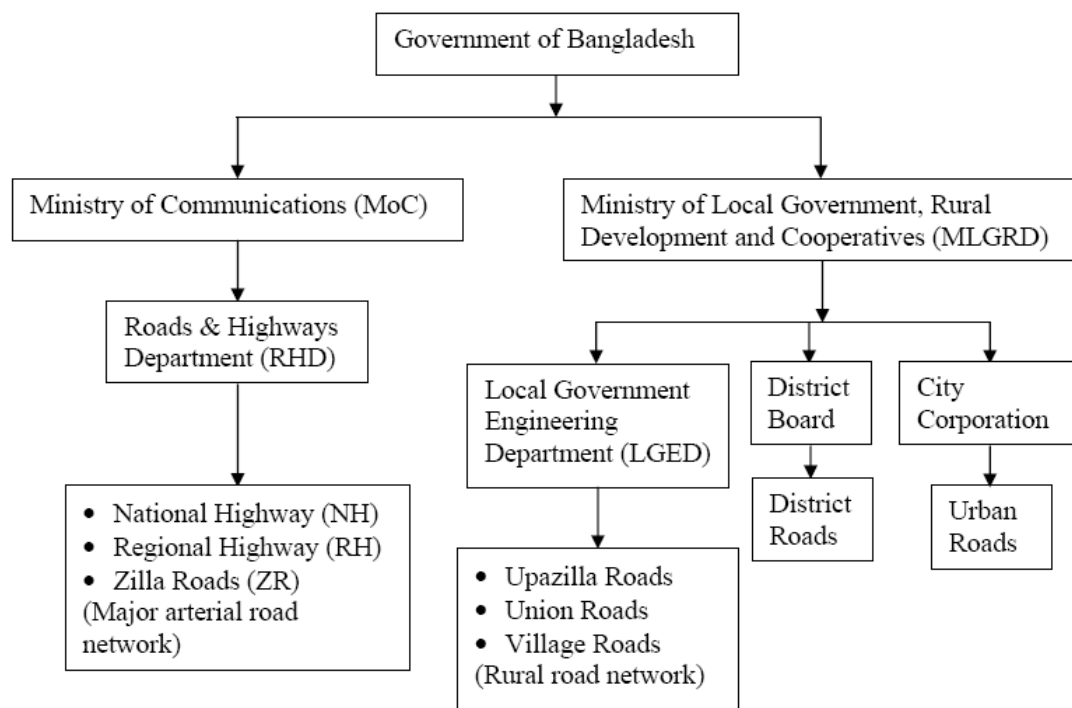


Table 1: Details of the road categories and responsibilities

RHD is the road authority in Bangladesh that manages the main road network, which includes National Highways, Regional Highways and Zilla Roads. RHD has 20,893km of road network of which 3,476 km are National Highway, 4,164 km are Regional Highway and 13,253 km are Zilla roads. The RHD paved road network is 17,557 km (84 % of total length). This year's analysis has been carried out on about 16,924 km of paved road of National, Regional and Zilla roads. Ongoing projects, which are in progress and were not completed before the start of Roughness survey, have been excluded from the HDM run to avoid duplication in the maintenance programme. RHD road network and lengths of roads are shown in Table-2.

Road Type	Total Road (km)	Paved Road (km)	Unpaved Road (km)	Paved Roads
National Highways	3,476	3,363	113	97%
Regional Highways	4,164	3,936	228	94%
Zilla Roads	13,253	10,258	2,995	77%
Total	20,893	17,557	3,336	84%

Table 2: RHD road network

RHD's vision is to provide a safe, cost effective and well-maintained road network. RHD has roads and other assets valued in excess of US\$7,400 million.

Road Type	Description	Length (Km)	Responsibility	Comments
NH	Roads connecting capital to districts and ports	3,476	RHD	RHD network is of 20,893km of which about 17,557km are paved. These are major roads in the country
RH	Roads connecting district to districts	4,164	RHD	
ZR	Roads connecting district to upazilla and upazilla to upzilla (shortest distance)	13,253	RHD	
Upazilla Road	Roads connecting upzilla to upazilla to union (shortest distance)	36,166 (17,889 km are paved)	LGED	LGED network is of 2,58,830 km of which about 43,713km are paved
Union Road	Roads connecting union to union	42,329 (8515 km are paved)	LGED	
Village Road	Roads connecting union to village and village roads	17,1335 (7583km are paved)	LGED	
City Road	Urban roads in the metropolitan cities	3,200	City Corporation	These are urban roads

Table 3: Road network in Bangladesh (RHD, 2006; RFEO, 2006 and LGED, 2005)

LGED has about 258,830 km of roads of Upazilla, Union and Village roads Type-A and B respectively (LGED, 2009). City Corporations have about 3,200 km roads (RFEO, 2006). The value of the paved roads network is about US\$ 8 billion in Bangladesh (RFEO, 2006)

3. Road Improvement and Rehabilitation

In early 70,s RHD made its journey with war ravaged net road network with only 3600 km paved road while local roads were managed by the district authorities. Without any standard road and pavement design some guide lines were followed and in 80,s a pavement design guideline was developed by the Bangladesh Road Research Laboratory (BRRL) supported by the than ODA (now DFID) and in most cases Road note 31 by Transport Research Laboratory (TRL) were widely followed. This guide line outlined pavement design in a very general manner in layers of granular and road base. Than a standard type design was drawn by the Planning Commission for different category of National, Regional and Feeder Roads where two layers of pavement structure were provided, sub base (brick chips + granular materials) and base (stone + brick chips). Roads thus constructed could not cater for the traffic with excess loads and quickly failed.

Thus the underlying pavement structure remained a threat to the pavement designers. Though surface condition of National highways has been maintained at a reasonable level over the last three years, underlying pavement strength are relatively poor and deteriorating while surface condition of Regional roads has gone worse with low pavement strength due to lack of maintenance and unless routine maintenance is prioritized the value of any rebuilding and periodic maintenance will be eroded. In general condition of Zilla road is very depressing with an IRI of greater than 8 and Road Sector Policy states that in order to achieve minimum accessibility level ZR net work will have to be rehabilitated in next 10 years.(Road Master Plan-RHD final report,2009).

The “Pavement Design Guide for Roads and Highways department” 2005 is followed generally to design RHD pavements which suggests 20 years design life which also to be revisited as future development will depend on two major events like construction of:

a) The Padma Bridge will connect southern part of Bangladesh with the capital and rest of the country and thus will allow uninterrupted traffic (without intervention of ferry) criss-crossing the country. The design phase have been commenced and world reputed consultants are engaged. The 5.5 km long steel truss bridge will have 120 to 130 spans and costing app. 1.8 billion US dollars. The client (GoB) is targeting end 2013 to open the bridge for traffic. There will be two level deck, the upper one with 4 lane road while lower deck will be used as rail way bridge .

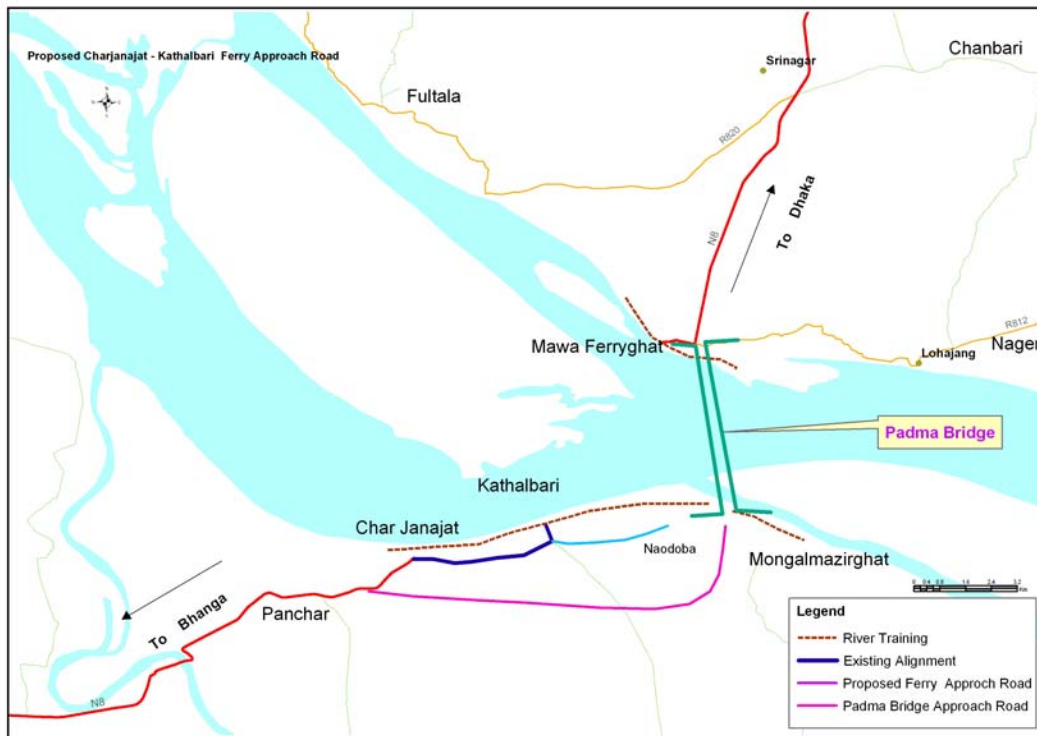


Fig.1: Location of Padma Bridge

b) The Ministry of Communication (MoC) decided to seek cabinet’s approval for joining of Bangladesh in The Asian Highway Network (AHN) determined by United

Nations Economic and Social Commission for Asia and the Pacific(UN ESCAP). Signing the agreement will enable Bangladesh connectivity with 32 countries. There are three proposed routes, two are the main routes which will connect India and Bangladesh and third one will connect India, Bangladesh and Myanmar. Already US\$ 26 billion has already been invested in the improvement and upgrading of AHN.

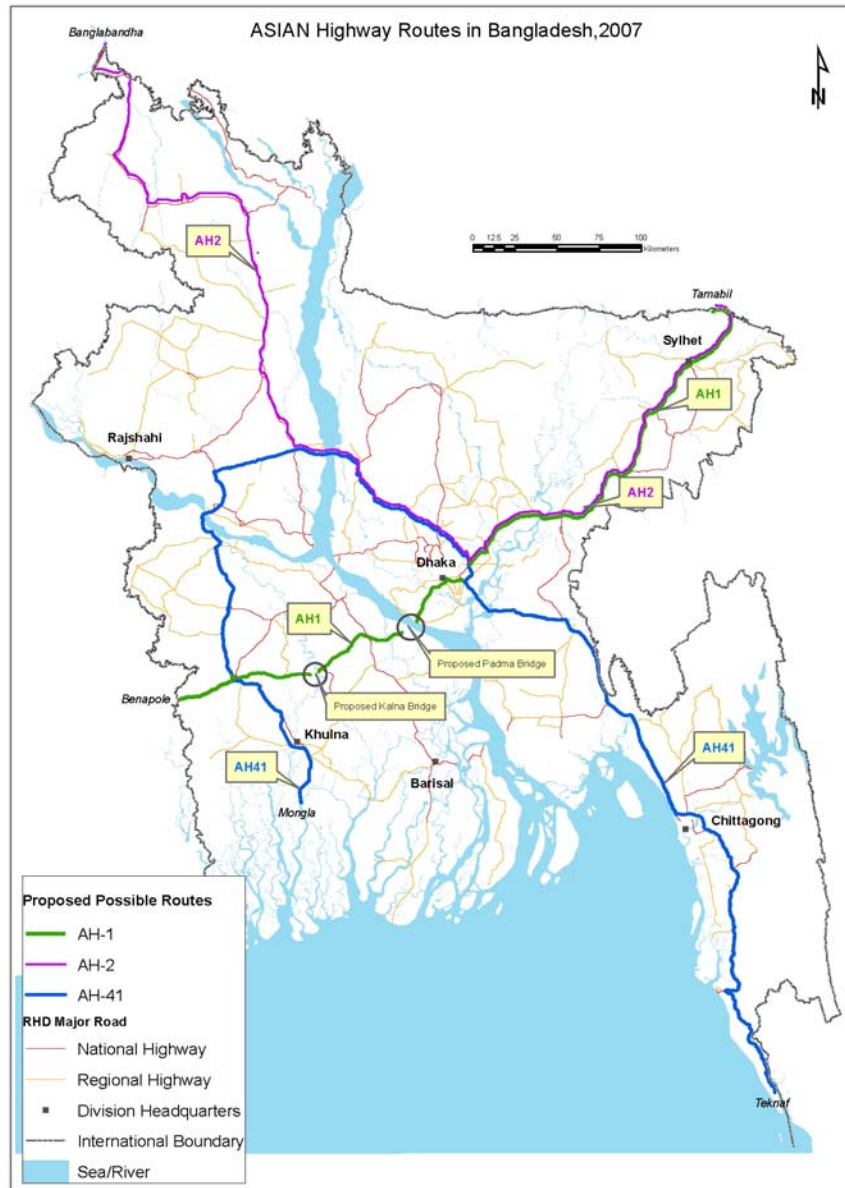


Fig:2 Asian Highway Route location showing three routes1) AH- 2) AH-2 3) AH-41

With these events network traffic pattern will be greatly affected and designers should think to reduce realistic time span to 10 years which will limit the risk of over/under estimation of traffic and will allow revision of projection during stage design and find out an integrated design for pavement and underlying structure in commensurate

with international and regional perspective. RHD has taken up a research program of developing an integrated pavement design with the University of Birmingham (UK) under financial assistance from DFID utilizing local representative road section and available materials. This effort is also need to be synchronized with above perspective.

4. Axle Load Control

Overloading of commercial vehicles cause excessive damage to pavements particularly on national and regional roads and cost Bangladesh over Tk 300 crore (US\$43M) per year in additional maintenance and rehabilitation needs. Overloading problem can be tackled in two conventional ways:

a) Axle load control

b) Incorporate in design

Though not acceptable, designers has no other option other than the second one at present situation.

Following legal load limit is recommended in the Road master Plan

Front 2-tyre single axle: 6000 kg

8-tyre single axle : 10200 kg

8-tyre tandem axle : 20000 kg

There is a plan to install 27 weigh bridges by RHD across the country. But strong enforcement and combination of punishments and comprehensive axle load control fully computerized and controlled toll connections to be introduced.

5. Road Safety

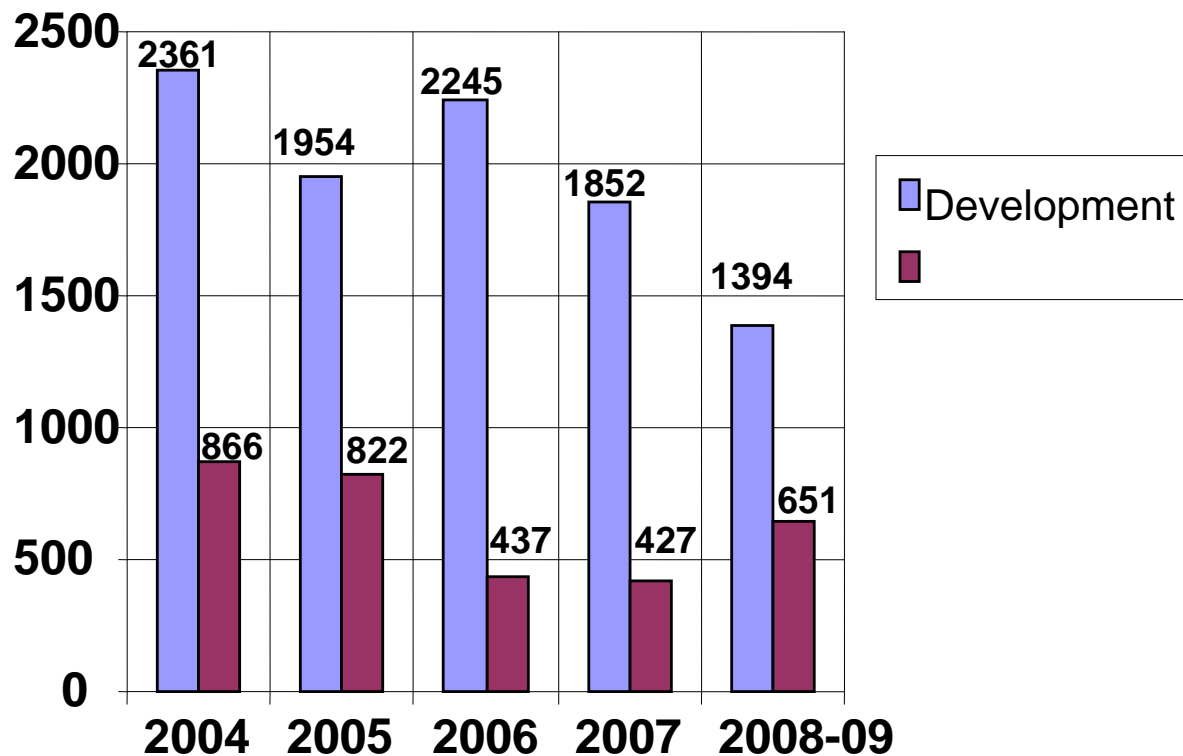
So far issue of road safety is not at all addressed apart from very stray effort in some of the donor supported road projects. But sustainability is greatly ignored. There has been a effort to dedicate at least some portion of the project cost for road safety and implementation safety audit during approval process.

6. Environment

Environmental issues were not addressed even few years back, off late environmental unit is created in RHD and Environmental Impact Assessment Manual and Mitigation Plan (EIAMMP) are drawn but yet to be approved nationally though in aided projects these issues along with resettlement matters like Resettlement Action Plan (RAP) are dealt with by the consultants. LGED has also developed their EIAMMP and are being used by the consultants.

7. Development fund and Maintenance fund

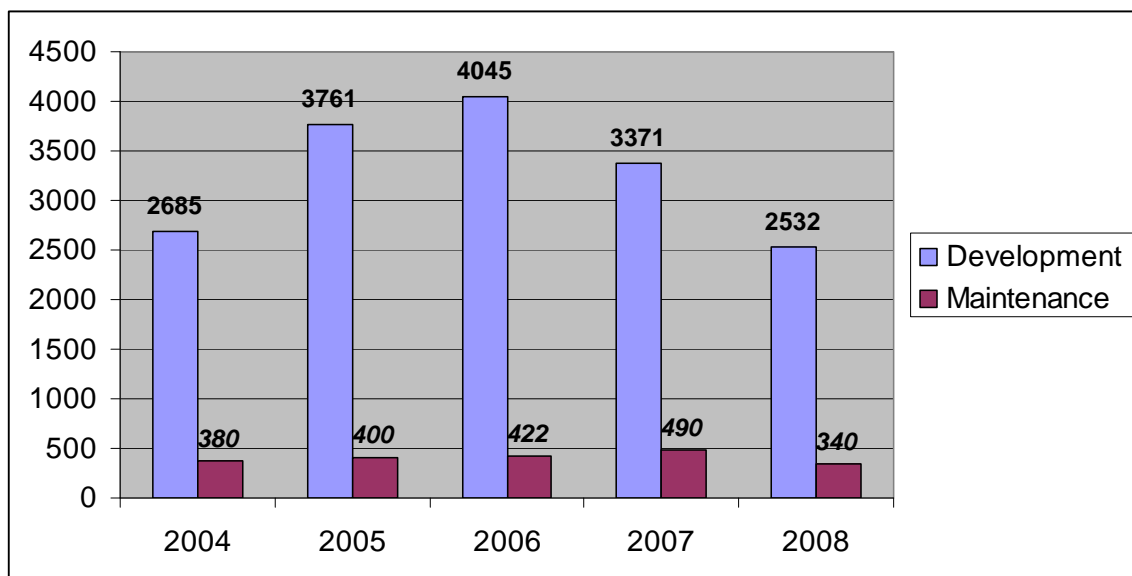
In last 20 years GOB,s allocation was mainly dedicated for development and Improvement of the road net work.



(1million US\$=TK70 million)

Fig. 3: RHD's Development and Maintenance expenditure in last 5 year

Scenario in LGED may be seen in fig:4 though LGED deals with different projects apart from transport which mainly deals with rural development, they put much importance in rural road network development and improvment.



(I million US\$=TK 70million)

Fig.4: LGED Development and Maintenance expenditure in last 5 years

It is seen from these pattern that maintenance was greatly ignored in last several decades resulting massive rehabilitation requirements causing headache to the policy makers. Though RHD adopted periodic maintenance program on national and regional roads supported by DFID and JBIC(debt cancellation fund) prioritizing the needs based on NPV/cost ratio LGED,s maintenance expenditure is almost one tenth of development. Recently DFID has shifted their focus from transport to other sectors leaving JBIC and GOB to fund PMP. GOB fund is irregular and some time not to the requirement. Sustainability of funding PMP in RHD is questioned in a broader sense. Zilla roads have low traffic volume and measuring VOC and Travel Time Cost(TTC) in these roads are very difficult as such Project Appraisal Framework(PAF) is used for appraising individual project.

The deterioration of the pavement condition over time combined with the limitation of funds available for maintenance and rehabilitation creates a challenging problem. Pavement preservation plays a key role in addressing this problem. Affordable, safer, and environmentally friendly pavement preservation practices are needed. Funding agencies as well as communities served by roads will be greatly benefited from these practices.

Serious economic consequences will result from a lack of effective management of this road network. Road Maintenance is directed to preserving the value of the roads asset by maintaining the durability of the roads and bridges. Without maintenance, these assets will rapidly deteriorate. No or lack of maintenance of roads has a cost to the economy. National economic growth is probably slowed down by about 1% of Gross Domestic Product (GDP) each year because of lack of maintenance (MOC, 2000). Road maintenance provides very high returns on invested capital. Typically periodic maintenance has an Economic Internal Rate of Return (EIRR) of between 40 and 100% compared with 8 to 15% for new construction. It was estimated that there is a loss of asset value of US\$ 400 million/year due to lack of maintenance, as a result, if no action is taken, after 20 years the road network will be unusable (RFEO, 2006).

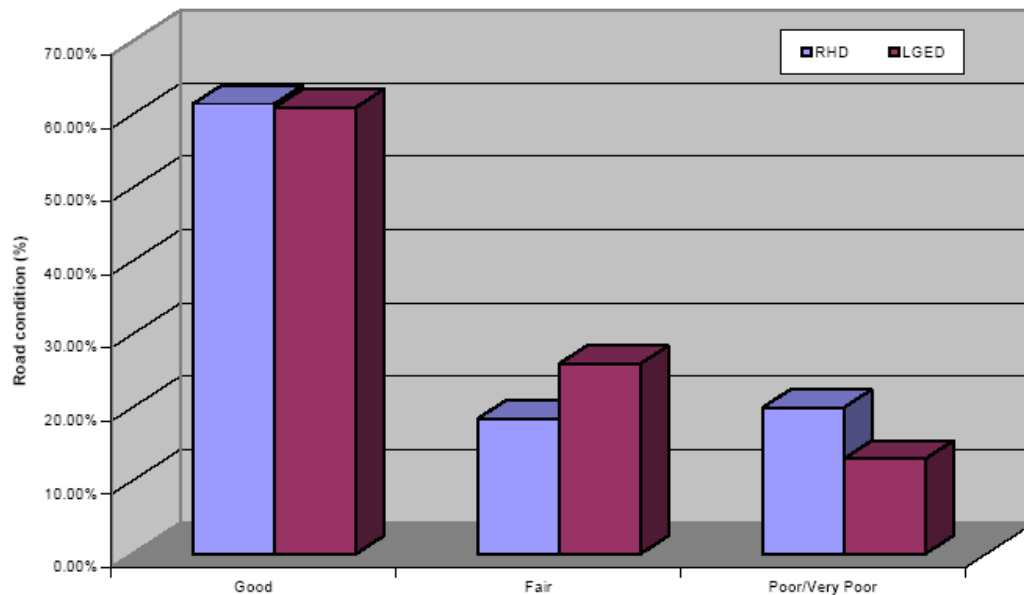


Fig.5: RHD and LGED road condition

8. Road Asset Management In Bangladesh

There are many examples of massive road assets being lost due to inadequate maintenance. A World Bank study of maintenance of countries in Sub-Saharan Africa concluded that US\$150 billions had been lost in the asset value of roads and bridges over a 20 year period due to a lack of maintenance (MOC, 2000). Efficient asset management can be achieved through proper and timely road maintenance. Maintenance expenditure saves money by reducing overall costs to the roads agency and costs to the road users. In developed countries, the vast majority of expenditure is spent on maintenance. However, to date insufficient attention has been given in Bangladesh to maintaining newly developed roads and many are showing signs of deterioration. It is clear that the current levels of maintenance being carried out on the road network are inadequate to maintain the roads in a satisfactory condition.

Previously, fund allocation for maintenance was done on the basis of visual inspection and scattered information. There was no systematic data collection, storing activity, logical prioritization criteria, and rational distribution of maintenance fund or scientific process for the identification of new projects (MOC, 2000). To utilize the allocated fund efficiently, a Pavement Management System (PMS) was required. RHD has now developed a very efficient PMS and road database based on a system of annual survey of road data. Survey data is stored in the RMMS database. Economic analysis for prioritization has been done using the HDM-4 model for decision-making. This gives a practically justified maintenance program. However, LGED has a simple PMS based on survey and engineering judgment. City Corporations do not have a system yet.

9. The RMMS Database and Data Quality

In 2004 RHD undertook a major survey of its network covering around 15,000 km of roads. The survey was comprehensive and included a full inventory, current condition

(including deflection measurements), pavement structure and traffic flows. In 2006 further surveys were undertaken, originally intended to complete the remaining 5,000 or so kilo meters that were not surveyed in 2004. Only around 2,000 km of the Zilla Roads omitted in 2004 were surveyed and around 1,500 km of National Roads were re-surveyed. In late 2007 further road condition surveys commenced and were completed in May 2008. These surveys undertook road condition assessment, traffic flows and deflection measurements (for National and Regional Roads only) but, most critically, did not update information on pavement structure.

Each year RHD has carried out roughness surveys in-house by the HDM Circle to provide the critical input to HDM. RHD uses Road Measurement and Data Acquisition System (ROMDAS) to obtain roughness data. Survey data of 2007-08 was utilized in this analysis to forecast current road situation using Road Deterioration Models of HDM-4.

Road Class	Road Condition Survey Length (km)	Traffic (Count station Nos.)	Deflection (Measuring Location nos.)	Roughness Survey Length (km)
National Highways	3,401	161	1,730	3,379
Regional Highways	3,840	161	1,212	3,262
Zilla Road	7,246	403	-	4,851
Total	14,487	726	2,942	11,492

Table 4: 2007-08 Survey Information

RHD manages the main road network, which includes National Highways, Regional Highways and Zilla Roads. RHD has 20,893km of road network of which 3,476 km are National Highway, 4,164 km are Regional Highway and 13,253 km are Zilla roads. The RHD paved road network is 17,557 km (84 % of total length). This year's analysis has been carried out on about 16,924 km of paved road of National, Regional and Zilla roads. Ongoing projects, which are in progress and were not completed before the start of Roughness survey, have been excluded from the HDM run to avoid duplication in the maintenance programme.

Network Name	Analyzed length (km) All Roads	Analyzed length (km) Excluding ongoing projects
National Highways	3,031	2,006
Regional Highways	3,775	2,768
Zilla Roads	10,118	7,000
Total	16,924	11,774

Table 5: Lengths of roads included in the HDM analysis

The HDM system provides an economic assessment of the possible maintenance treatments of all paved roads of RHD road network and then places these in priority order. The system can also determine the most economically effective means of carrying out maintenance when funds are limited. It was shown that HDM-4 outputs are generally used for the yearly maintenance and rehabilitation program. Recently, RAMS has been developed by RHD to present the annual maintenance program in a more understandable manner allowing the preparation of contract packages in a manageable way. Maps prepared under RAMS from HDM-4 results identify the ongoing, critical or priority maintenance projects.

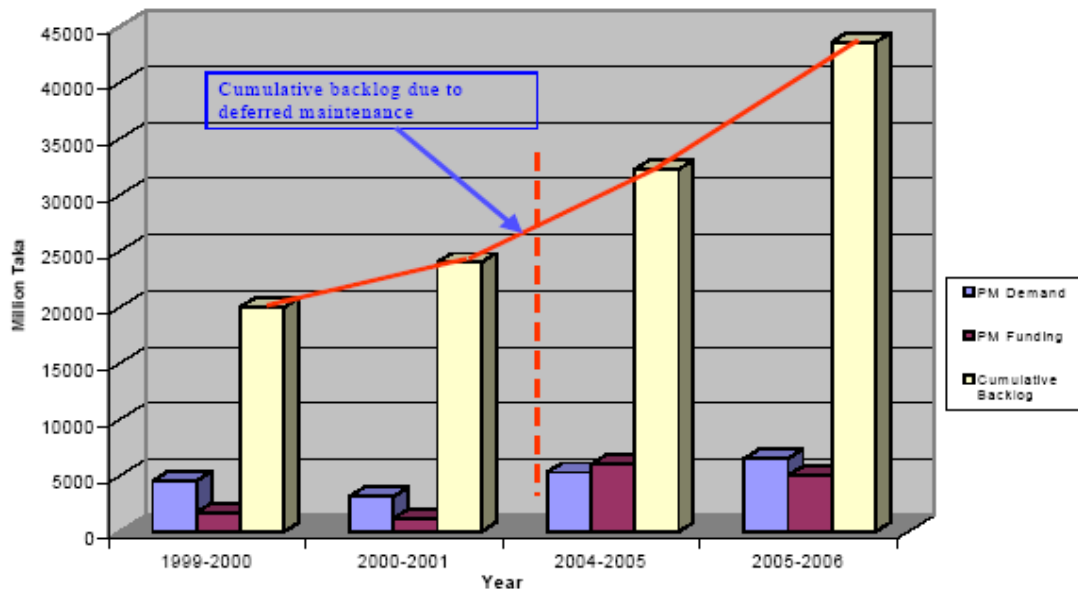


Figure.6: Backlog situation in RHD up to 2006 (1US\$ million = 65 million taka)

The current Maintenance and Rehabilitation Needs Report (MRNR) of 2008-09 for Roads and Highways Department (RHD) for paved roads is the ninth annual report produced based on the outputs from the Highway Development and Management (HDM-4) Model. The purpose of this report is to develop a 5-year investment plan to meet acceptable levels of service provision for the RHD network. RHD has used the HDM-4 for their maintenance management system as an economic tool since 1999-2000. The outputs from HDM-4 are based on the Road Maintenance and Management System (RMMS) database of RHD. This report also provides recommendations for Managers and Engineers in RHD to improve the road network in a cost effective manner. Immediate needs of RHD network are shown below:

Immediate Needs

Table 1.1 shows the total budget required for maintenance and rehabilitation of RHD Roads for the year 2008 - 2009. This figure assumes that there are no budget constraints.

Routine Maintenance	Periodic Maintenance	Partial Reconstruction	Full Reconstruction	Total
967	9,449	11,833	5,979	28,228

Table 6: Immediate Maintenance Needs 2008-2009 (million Taka)

Five-Year Needs

The above figures represent an ideal budget to carry out all necessary maintenance and rehabilitation in one year. Clearly this level of budgeting is impractical and therefore an average value, adjusted to allow for the increased cost of deferring maintenance is proposed.

Year	2008-09	2009-10	2010-11	2011-12	2012-13	Total
Total	17,963	20,167	20,812	20,593	19,514	99,049

Table 7: Overall Maintenance Needs 2008-2013 (million Taka)

This year (2008) analysis has been carried out on about 16,924 km of roads, by RMMS database of RHD. Previous studies pointed out about inconsistencies and incompleteness of the RMMS database (Khan, 2004; ARRB, 2003). Khan showed that only 5% of the whole database is reliable using the 1996-2002 data. A road database should be assessed for reliability before use for decision-making purposes.

This check must be done using statistical and range check methods, such as those utilized by Khan. PMS implementation requires a valid model to measure total life-cycle performance, costs and benefits for several road maintenance and rehabilitation alternatives for a road network (Watanatada, et al. 1987). The HDM-4 model can be utilized for these purposes, and RHD has been using the HDM-4 model since 1999-2000. HDM-4 requires data on the road network, vehicle fleet, road works and configuration for analysis. The HDM system provides an economic assessment of the possible maintenance treatments of all paved roads of RHD road network and then places these in priority order. The system can also determine the most economically effective means of carrying out maintenance when funds are limited. HDM-4 outputs are generally used for the yearly maintenance and rehabilitation program. Recently, RAMS has been developed by RHD to present the annual maintenance program in a more understandable manner allowing the preparation of contract packages in a manageable way. Maps prepared under RAMS from HDM-4 results identify the ongoing, critical or priority maintenance

The Maintenance Circle of RHD uses the HDM-4 outputs to determine a yearly Periodic Maintenance Program (PMP). Rehabilitation, reconstruction and widening works are normally conducted through the Annual Development Program (ADP), funded by the Donors and Government. Maintenance works are generally implemented by the field divisions and by the foreign aided projects. Tenders are invited by the Maintenance Circle to implement these projects. To implement periodic PMP efficiently, Quality Assurance (QA) of road works has been made mandatory. The newly introduced Central Management System (CMS) records the financial and physical progress of a project. Post evaluation of maintenance works can be done through several tests. All these ensure

efficient implementation of the PMP program and ultimately sound management of RHD's assets. But institutional capability of RHD has not yet developed to cater for the needs to support CMS and RAMS.

LGED has also developed a road database recently. Roughness survey is carried out in different road links. But utilizing economic tool to obtain a rational yearly programme to manage the road network is not yet complete. In most of the cases engineering judgment is used to evaluate collected data, which might impact on project selection.

10. City Corporation-PMS

In Bangladesh City Corporations manage urban roads. However, their PMS is very weak, e.g., data collection is rare. This affects the overall asset management system. They lack economic tools and efficient project implementation. It should be mentioned here that political interference has a large impact in Bangladesh in managing assets. RHD tries to overcome this problem by using RAMS maps.

11. Results for RHD

The HDM analysis for RHD network shows that backlog mitigation requires US \$ 250 million over 5 years. About US \$ 153 million per annum will be required once the level of maintenance stabilizes. At the present time, expenditure on maintenance activities is estimated at US \$ 100 million per annum; an annual shortfall of US \$ 53 million (RHD, 2006); this can be seen in Figure 10. RHD has received US\$ 67 million for PMP (Periodic Maintenance Programme) in 2006-07 from Government, DFID and Japan Bank for International Cooperation (JBIC).

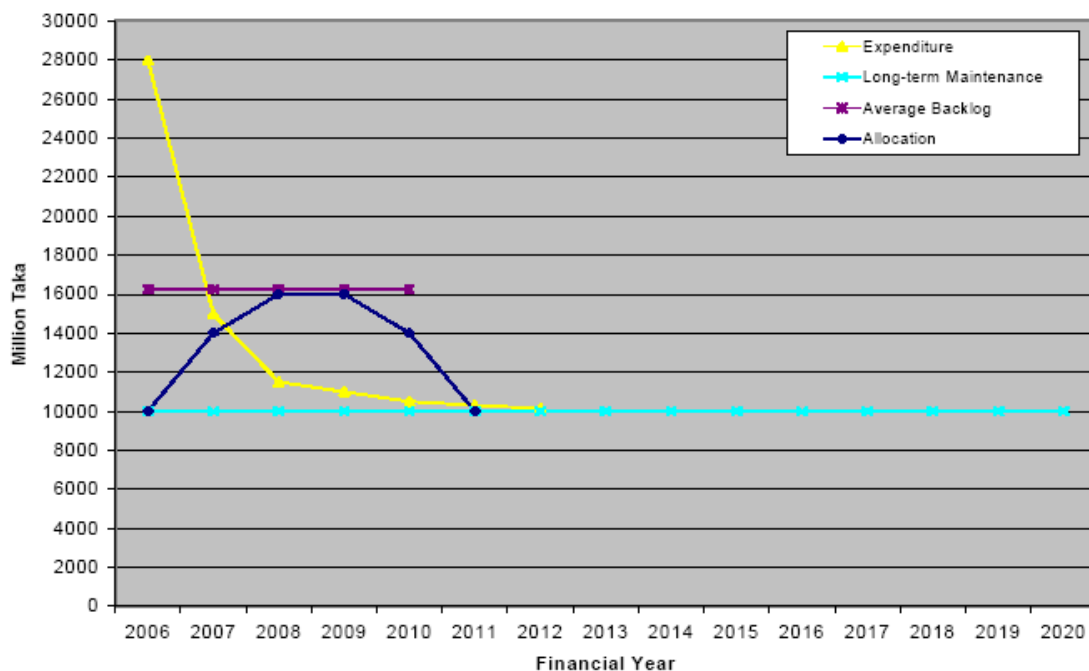


Fig.7: Back log and funding requirement up to 2006 (RHD 2006)

However, a large part of this money is for small-scale work that does not provide the durability of larger-scale well-controlled maintenance works. In addition to the above long-term maintenance needs, the immediate problem is to deal with the very high levels of maintenance required during the next few years (see Figure 11). These high levels of maintenance are a result of current levels being well below the requirement so that a backlog of deferred maintenance has developed. The unconstrained cost needed for periodic maintenance and rehabilitation for the first 5 years of the analysis period is shown in first year (2008-09) unconstrained works from the HDM-4 analysis.

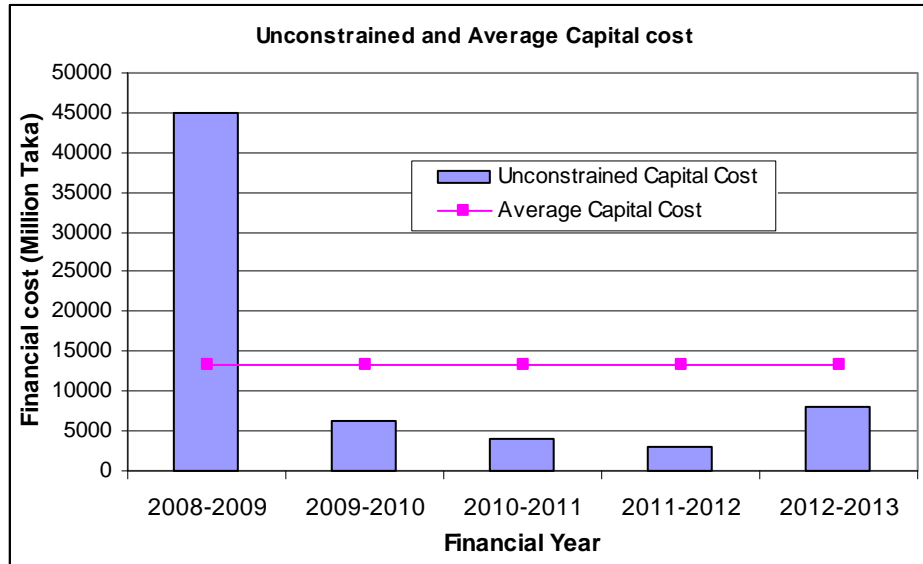


Fig.8: Unconstrained and average demand of capital works for the next five years.

Road type	2008-09	2009-10	2010-11	2011-12	2012-13	Total
National	13,131.35	3,957.14	1,889.15	1,286.62	598.95	20,863.21
Regional	10,017.00	2,189.71	2,533.47	1,887.08	966.99	17,594.25
Zilla	22,658.25	1,390.98	1,064.71	1,305.59	7,912.54	34,332.07
Total	45,806.60	7,537.83	5,487.33	4,479.29	9,478.48	72,789.53

Table 9: Total maintenance and rehabilitation demands (Mill Tk) for the next five years.

A great deal of work has been achieved in clearing the backlog over the past few years through a number of development projects. It is not viable to clear the remaining backlog immediately, it will be necessary to continue this effort over the next decade in co-ordination with RHD's maintenance planning unit.

12. Results for LGED

Details of LGED assets are in the Rural Road Master Plan. It was stated that LGED requires US\$ 8,660 million for the next 5 years (LGED, 2005).

LGED actually received US\$ 59 million for maintenance, which was 69% of the total maintenance need of 2005-06 (LGED, 2005). The rehabilitation need was met from development funding from Government and foreign donor agencies. It was estimated that LGED has current maintenance backlog of US\$ 125 million (LGED, 2005).

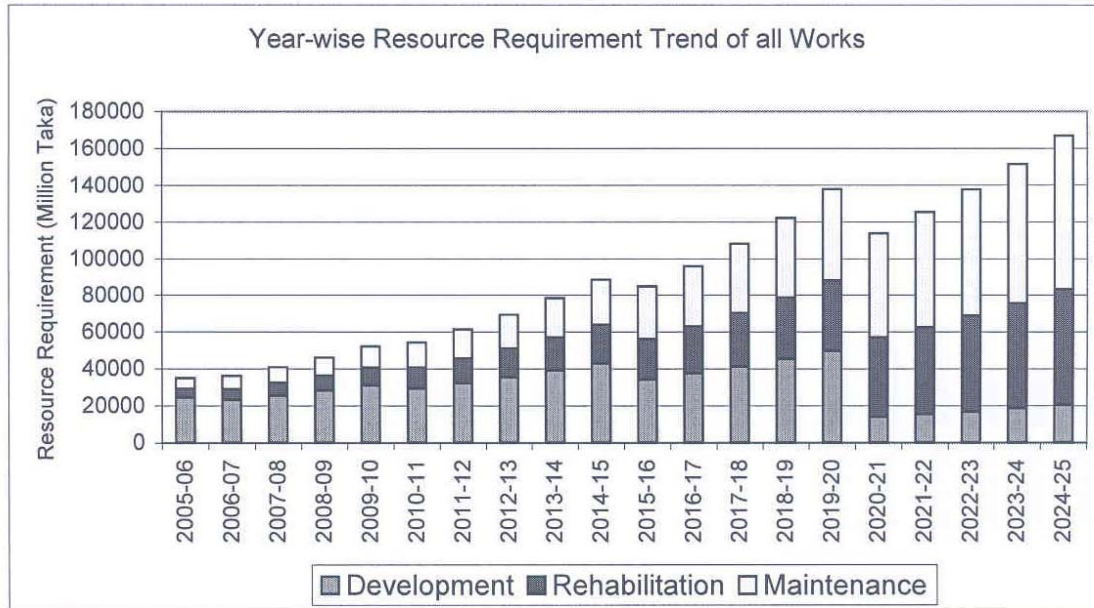


Fig.10: Year-wise resource requirements for the LGED roads

13. Results for City Corporation

It was estimated that City Corporations require US\$ 4.50 million for routine maintenance and US\$ 21.50 million for periodic maintenance (RFEO, 2006). Finally, it was estimated that total maintenance demand in Bangladesh is about US\$ 215 million of which Government funding is around 50%. Again, backlog is US\$ 385 million (RFEO, 2006).

14. Sustainable Maintenance Strategy

The above discussions show that road network cannot be maintained properly due to a lack of funding, political pressure and poor QA. The reliability of HDM data base has been greatly questioned in last few years as such immediate measures are necessary to improve data quality and ensure steady fund flow with restricted interference,.

a) Road Fund Board (RFB)

About 55000 km of roads in Bangladesh are damaged by different reasons in almost every year and not maintained properly. GOB can no more afford to provide fund of the

same magnitude both for Development and Maintenance activities resulting alarming deterioration of pavement structure multiplying every year. It is observed that current maintenance backlog and effective maintenance require more funding to achieve road users' satisfaction. However, the Government is not capable to give further fund. Inadequate maintenance may be due to:

- insufficient funding,
- money is allocated but not spent,
- money is not spent efficiently, and
- money is not spent effectively.

It is an immediate need for commercialization of road management like a business. Several reforms are suggested and most important is identified as to develop a Road Maintenance Fund to guarantee funding for routine and periodic maintenance. A draft of Road Fund Board Act is under consideration in MOC and being recommended to the cabinet. The Board shall consist of the members from different key GOB, stake holders and business community represented by Bangladesh Chamber of Commerce and Industries.

It was observed from the recent RUC study that road users are willing to pay for better roads, which can ultimately ensure efficient asset management. The most common method of road funding is the “fee-for-service” concept under which road users' pay directly for the services they consume. This is achieved by paying road user revenues (such as fuel levies) directly into a commercially managed road fund. The new Road Fund aim to ensure the public gets value for money from any spending.

It is obvious that road users have to be involved in road management through RFB which shall consist of the members from different ministries of GOB, Stake holders and business community represented by Bangladesh Chamber of Commerce and Industries. It is a common saying that “user pay, users say”. Generally, the road fund will be used to maintain NH and RH and to eliminate the maintenance backlog. Sources of road fund may be fuel levy, license fees for heavy vehicle, mass-distance charges, tolls and permit-based charge. A suggested Phasing in road user charges for the next 6/7 years is shown in Figure 9. The Percentages of demand as shown in Table 4 above suggest the allocation of maintenance funds for different road agencies from the Road Fund.

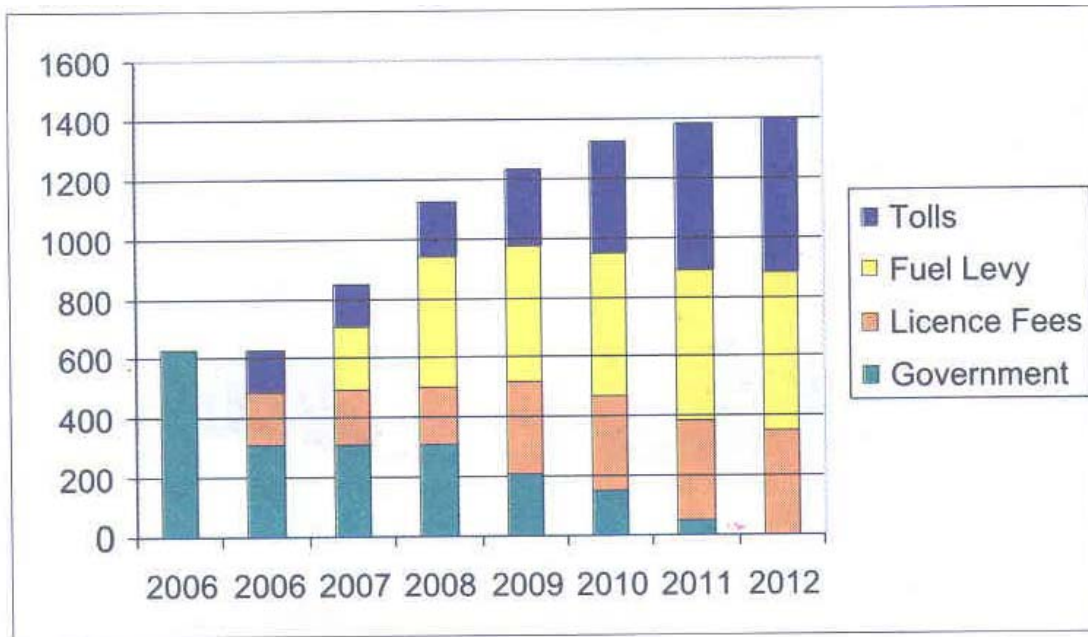


Fig.11: Financial strategies for Road Maintenance Fund (RFEO 2006)

b) Privatization of Highway Infrastructure

Privatization is the process of transferring productive operations and assets from the public sector to the private sector. In the broader sense to involve the private sector to the traditional government service and facilities. Amongst a number of factors that have allured increasing participation of the private sectors most important cause is the shortage of public fund. The gap between infrastructure needs and GOB,s own resources available and aid from external agencies. Strict financial control and administrative constraints have been pinpointed that prevent timely implementation of much needed infrastructure. Private involvement overcomes these stages in self styled efficient manner in terms of

- time saving,
- more infrastructure earlier,
- optimization of public administration costs,
- introducing pricing policy, and
- introducing criteria to decide which quality level is to be offered.

Following models are available for the privatization scheme in road infrastructure:

1. Operation and Maintenance Contract(OMC)
2. Lease- Develop-Operate(LDO)
3. Build-Own-Operate-Transfer(BOOT)
4. Build-Transfer-Operate(BTO)
5. Build-Operate-Transfer(BOT)
6. Build-Own-Operate(BOO)

It is observed that Public Private Partnership (PPP) can better maintain assets by improving quality of service, better management and technical innovation.

The, PPP has already been introduced and it provides an efficient management of assets. Government of Bangladesh recently accepted and circulated Bangladesh Private Sector Infrastructure Guidelines (PSIG), which emphasize the land transport sector, highways and expressways including mass-transit, bridges, tunnels, flyovers, interchanges, city

roads, bus terminals, commercial car parking etc. (PSIG, 2004). Details of private sector partnership are discussed in the guidelines and this is encouraged in the road sector. PPP is not yet popularly motivated and unless government is keen to abide by the guidelines narrow down the limitations the real benefit will not be achieved.

c) Performance Based Maintenance (PBM) Contracts

Performance-based contracts (PBC) differ broadly from Method-Based contracts (MBC) that have been used traditionally to maintain roads. The basic differences between PBC and MBC are:

1. MBC- Road agency as a client normally specifies techniques, technologies, materials and quantities etc. The payment to the contractor is based on the quantity of inputs against each item in the bill of quantities.
2. PBC- The client does not specify any method or material requirements rather performance indicators are specified that the contractor is required to meet when delivering maintenance services

A comprehensive PBC would typically cover all road assets with the right- of – way and comprise the full range of services needed to manage and maintain the contracted corridor.

PBM contracts can be given for short period (5 years) or for long period (30+ years). It can ensure improved service and road users' satisfaction; as a result, road assets may be maintained in an efficient way.

There is no PBM (PBC) contract in Bangladesh, though it is common in the developed countries of the world. In two of the RHD projects, RNIMP(Road network improvement and maintenance project)-1 and RNIMP-2 there have been provision for PBM contracts in a limited way. But main area of risk assessment is not yet taken into consideration.

15. Conclusions

Road management has to be considered as protecting a massive national asset and must be treated as a business. In the short term, the development budget needs to be used to overcome funding deficits in maintenance strategies and to clear the backlog with assistance from development partners. Pavement design and related parameters of axle load, traffic volume, geometrics etc should be given a potential magnitude in view of the international and regional concept. Lessons from failures of RHD road projects may be taken in future road designing. Emphasis should also be given towards building climate clean roads. Certain portion of the development budget to be earmarked for road safety and environmental issues by provision in the DPP. In the longer term, new ways of road management probably using a 'Road Fund' can be considered by establishing a RFB (with public and private participation). Road Fund formulating policies for stable and adequate funds for management of the nation's road assets is essential for the growth of the economy. Since government has incorporated several PPPs in current years ADP and started processing for several highway and urban flyover and elevated expressway projects for better management and quality of service with an expectation to improve asset management. Road agencies should formulate medium and long term plans for

institutional capacity building and gradual shift to the corporate environment for better value for money service.

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Technical Papers

- A. Network Preservation of RHD roads: Bangladesh - 6th 'International Conference on Management of Pavements (ICMP6) Brisbane, Australia, 18-24 Oct '04.
- B. Highway Design for Economy and Safety – South Asia Regional Cooperation (SARC) seminar on Road Transportation and Safety, Dhaka, December, 1986.
- C. 'Road Network Preservation' – Institution of Engineers Bangladesh (IEB) Journal – 2003.
- D. Asset Management: Technical Inputs To Decision Making - 23rd world Congress, 17-21 Sep-07, Paris.
- E. Disaster Mitigation: Floods in Bangladesh - 23rd world congress, 17-21Sep-07, Paris

